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WASHINGTON, D.C. 20231

CASE DOCKET NO. YOR920000360US2
DATE: October 10, 2000

Transmitted herewith for filing is the Patent Application of:

Inventors: Ali Afzali-Ardakani, Tricia Lynn Breen, Jeffrey Donal Gelorme, David Brian Mitzi and Michael Joseph Rooks.

For: HIGH SENSITIVITY CROSSLINKABLE PHOTORESIST COMPOSITION, BASED ON SOLUBLE, FILM FORMING DENDRIMERIC CALIX[4]ARENE COMPOSITIONS METHOD AND FOR USE THEREOF

Enclosed are:

X 2 Sheets of Informal Drawings.

X An assignment of the invention to International Business Machines Corporation, Armonk, New York 10504.

___ A certified copy of a _____ application.

X Declaration and Power of Attorney is attached to the application.

___ Associate Power of Attorney.

___ Information Disclosure Statement with form PTO-1449 with references attached.

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Respectfully submitted,

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In re application of: A. Afzali-Ardakani et al. Docket No.: YOR920000360US2
Serial No.: Group No.:
Filed: Herewith Examiner:
For: HIGH SENSITIVITY CROSSLINKABLE PHOTORESIST COMPOSITION, BASED ON SOLUBLE, FILM FORMING DENDRIMERIC CALIX[4]ARENE COMPOSITIONS METHOD AND FOR USE THEREOF

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HIGH SENSITIVITY CROSSLINKABLE PHOTORESIST COMPOSITION, BASED ON SOLUBLE, FILM FORMING DENDRIMERIC CALIX[4]ARENE COMPOSITIONS METHOD AND FOR USE THEREOF

FIELD OF INVENTION

The present invention relates to high sensitivity, soluble, film forming photoresist composition of dendrimeric calix[4]arene derivatives and processes for forming lithographic patterns therewith.

BACKGROUND OF INVENTION

There is continuing effort in electronic industry to achieve higher circuit density in electronic devices. To archive higher degree of integration, new and improved lithographic tools and techniques have been developed which in turn demand new photoresists that could enhance the resolution of lithographic patterns. Aqueous base developable photoresists which are formed through crosslinking have been disclosed by Reck et at., SPIE Regional Technical Conference on Photopolymers, Ellenville, NY 63, 1988 and in US patents 5,034,304 and 5,204,225 to Feelyt. Such formulations were characterized by polymers having an aromatic moiety, like polyhydroxy styrene or novolak, which are susceptible to electrophilic aromatic substitution, and a crosslinking agent, which can form a carbonium ion upon treatment with acid and a photoacid generator. US patent No. 4,810,601 to Allen et al. is concerned with formation of negative tone resist patterns by crosslinking an aromatic compound with monomeric or

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polymeric source of carbonium ions. Thus, diacetoxymethyl benzene and trisacetoxymesitylene were used with triphenylsulfonium hexafluoroantimonate to crosslink a poly(hydroxystyrene) matrix.

U.S. Patent No. 5,296,332 to Sachdev and Japanese patents 2-15270 and 1-293339 to Kokai describe aqueous base developable resist composition comprising of a phenolic resin like poly(hydroxystyrene) or Novolak, a crossinkable agent which can form carbonium ion upon treatment with acid, and a photoacid generator.

Calixarene based, organic developable crosslinkable photoresists compositions which are formed through crosslinking have been disclosed by Pfeiffer et al., Microelectron Eng. 1998 42/42 p359-362 and Fujita, J. et al., in Japanese Journal of Applied Physics, Part 1., 1997, p. 7769-7772 and in U.S. patents 5,702,620 to Fujita et al., the use of calix[n]arene derivatives, where n=4-8.

SUMMARY OF THE INVENTION

A broad aspect of this invention is a high sensitivity photoresist compositions for generating sub 100nm negative tone resist images on a substrate, particularly through the use of E-Beam energy. Another aspect of this invention is the use of a dendrimer composition that has a Calix[4]arene molecule as the core for such photoresist applications. The use of calix[4}arene as the dendrimer core makes the synthesis and isolation of relatively large quantities of this type of molecule practical for large scale

manufacturable. The compositions of this photoresist consists of (a) a functionalized calix(n)arene molecule that forms a film, with pendant aliphatic hydroxy groups, (b) an acid catalysable crosslinking agent selected from aminoplast family and more particularly from glycouril derivatives and (c) a radiation degradable acid generator to assist in crosslinking of the film former. The calixarene molecules of the present invention are selected from the Calix[4]arene series, (Fig 1)

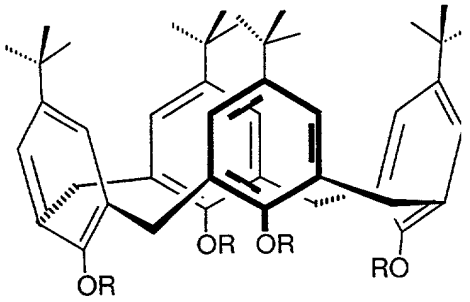
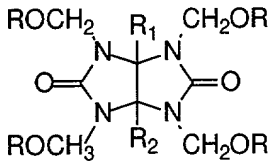


Fig. 1. Representation of 4-tert-Butyl Calix[4]arene core molecule

Calixarene molecules are macrocylic compounds containing four to 8, m-bridged aryl rings of substituted or unsubstituted phenols. Several examples of these materials have been reported to give exceptionally high resolution, negative tone images in e-Beam lithography. It is thought that this result is due to the small dimensions of these highly crystalline molecules. The difficulty in using these types of materials in large scale manufacturing is due to the fact that, since these molecules *are* crystalline, have high melting points and are practically insoluble in common organic solvents, the 4-tert-butyl calix[4]arenes in particular must be highly derivitized to yield a film forming resist composition. Although several ring derivitizations and sizes (i.e calix[6] and [8]

arenes) and unique solvent mixtures have been reported to give film forming resist formulations, these methods are still impractical for general manufacturing. The biggest barriers to production scale use is the low E-beam sensitivities. Similarly, dendrimers - multifunctional compact spheres with the same molecular weight and amount of functional end groups, but smaller size versus the 'random walk' configurations of their linear homologues- have been proposed as resist candidates. A large number of dendrimers reported are based on amide, ester or ether linkages. In contrast to calixarenes, dendrimers are easy to synthesize and soluble in a wide variety of common organic solvents, but have not been reported as E-beam resists. The major disadvantages of these types of dendrimers are their low Tg'sor melting points (< 100 deg. C) that would be expected to result in image distortion during post expose thermal processing. We report here a combination approach of using 4-tert-butyl calix[4] arenes as the high melting core molecule for dendrimers to provide for soluble, film forming, small molecular radius, aliphatic ester dendrimer molecules with much higher E-beam sensitivities. These unique materials therefore combine the advantages of both dendrimers and calixarenes because they are easier to synthesize and purify , and are far more sensitive to e-beam radiation.

The crosslinking agents of this composition are selected from Glycouril derivatives shown in the formula:



Glycouril derivatives

in which R is an alkoxadical, preferably $CH_{2o}CH_{3,}$ and R1 and R2 can individually be selected from hydrogen, alkyl or aryl groups. The composition of the present invention also includes a radiation degradable acid generator.

The present invention also provides a method of using new resist composition for generating negative tone resist images on a substrate which comprises:

a) coating the substrate with a film comprising of a film forming calixarene selected from glycoluril derivatives and a radiation degradable acid generator;

b) imagewise exposing the film with E-beam radiation to cause crosslinking in the exposed portion of the film;

c) baking the said substrate at elevated temperatures, and

d) developing film in an aqueous base developer.

The present compositions are sensitive to Ebeam radiation. The resist speed can be adjusted by adjusting the ratio of the crosslinker to polymer resin.

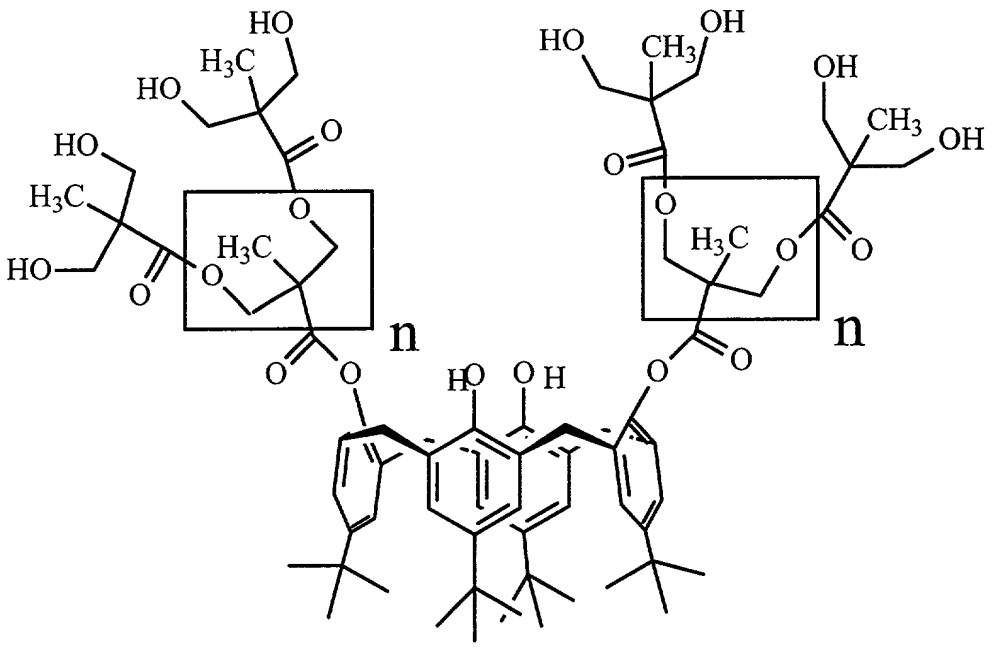
BRIEF DESCRIPTION OF DRAWINGS

These and other objects, features and advantages of the present invention will become apparent upon a consideration of the following detailed description and the invention when read in conjunction with the drawing Figures, in which:

Figures 1 and 2 are photomicrographs showing images made using different compositions of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

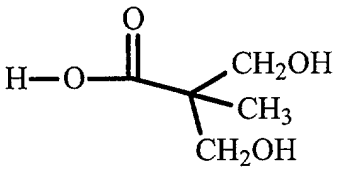
The present invention relates to high resolution, organic solvent developable E-beam photoresist compositions for generating negative tone images on a substrate. These compositions comprise (a) a film forming calix[4]arene dendrimer derivative of generation >2 with aliphatic hydroxyls (b) a glycoluril derivative crosslinker which upon acid catalysis can react with the phenolic functionality and form crosslinks, (c) a photodegradable acid generator which upon exposure to UV or E Beam radiation forms the acid catalyst needed for the formation of the crosslinks. The aliphatic hydroxyl containing film forming resin is selected from dendrimers, of 4-t-butyl-calix[4]arene that is disubstituted with dimethyol propionic acid moities shown below:



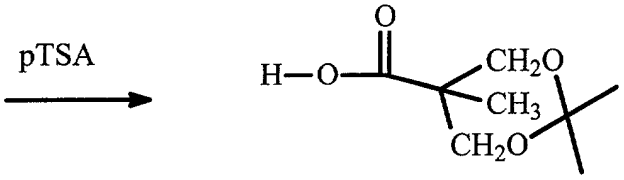
The composition in this invention consist of the above calixarene dendrimer where n is equal to or greater than one. In an embodiment of this invention , this molecule is made from a stepwise dendrimer synthesis from 4-t-butyl calix[4]arene and the acetonide. The concept of Dendrimer synthesis is described in Tomalia et al. in US 4,507,466. The concept of using dimethoyl propionoic acid in dendrimer synthesis is outlined by Hult et al., in Macromolecules, 1995, 28 (5) p 1698-703.

General procedure for the dimethyol propionic acid ester dendrimers using 4-t -butyl calix[4]arene as the core molecule

1. Formation of Dimethyol Propionic Anhydride

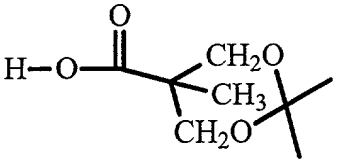


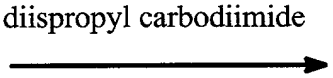
Dimethoxy propane

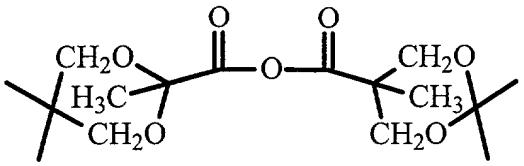


'acetonide protection'

Dehydration of Acid Acetonide to Anhydride

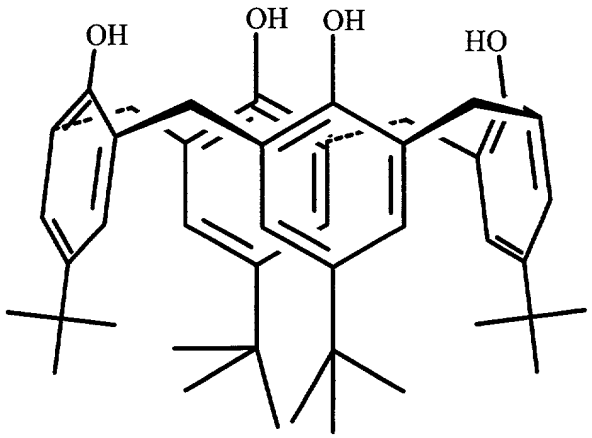
2 





' DMPA$_3$ '

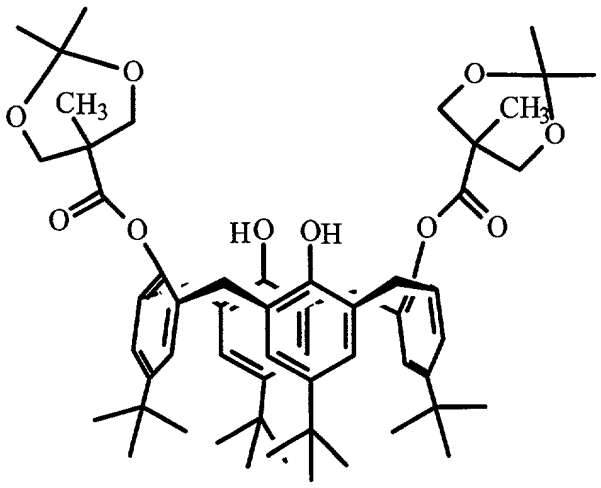
2. Functionalization of Calix[4]arene



+ (X) DMPA3

BASE

DMF

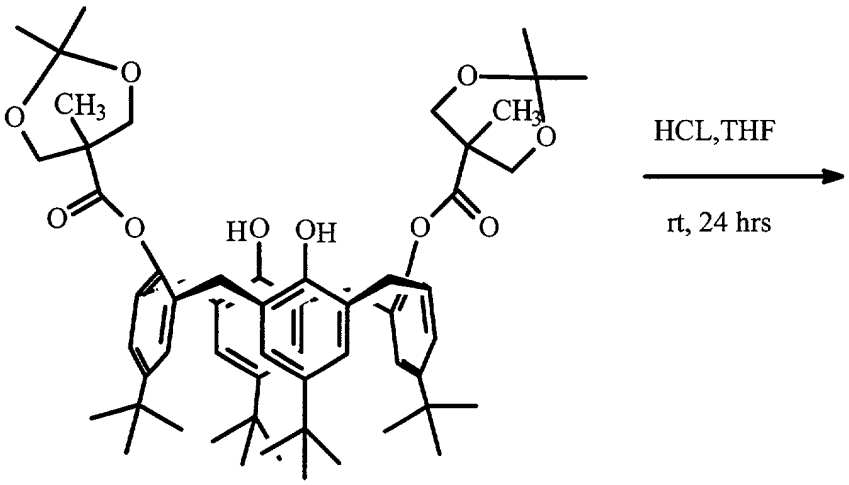


Disubstituted

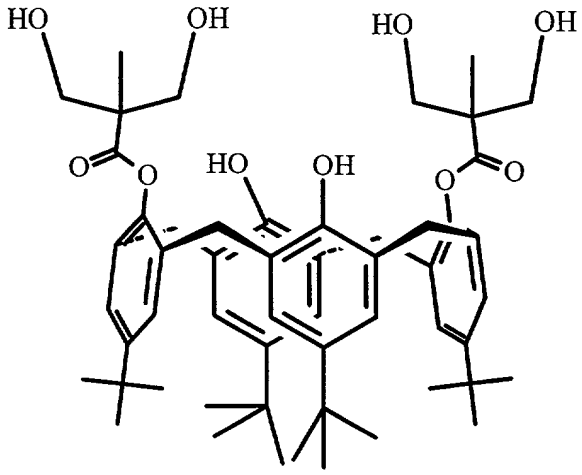
ONLY !!

only product (>90%.) no matter what the conditions!!
from slight excess to 100 X stoich excess , from 80c
to 300 c (neat solution)

3. Acetonide deprotection and generation expansion



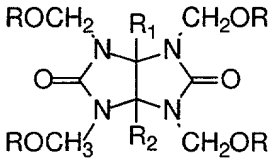
Generation 1 (or 0)



deprotected generation one

deprotected generation + 'DMPA3' ⟶ generation 2 , etc

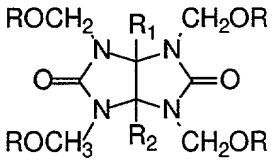
Crosslinkers for the compositions of this invention are Glycoluril derivatives of general formula:



Glycouril derivatives

in which R is a alkoxy, preferably CH2OCH3, and R1 and R2 can individually be selected from alkyl groups having 1-6 carbon atoms exemplified by

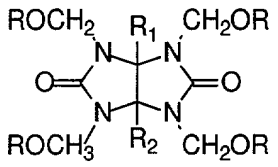
(a) tetrakis-methoxymethyl-3a,6a-diethylglycouril,



Glycouril derivatives

(b) tetrakis-methoxymethyl-3a-methyl-6a-propylglycoluril and

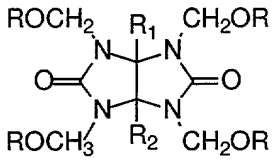
(c) tetrakis-methoxymethyl-3a-methyl-6a-butylglycoluril as shown in the following formula:



Glycouril derivatives

R1 and R2 can also be selected from alkyl and aryl group or hydrogen and aryl groups like (d) terakismethoxymethyl-3a-phenylglycouril and

(e) tetrakis-methoxymethyl-3a-methyl-6a-phenylglycoluril as shown in the following formula:



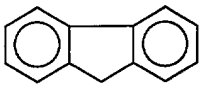
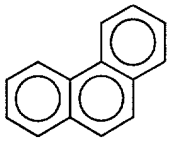
Glycouril derivatives

The composition of the present invention also preferably includes a photoacid generator (PAG) which can be selected from onium slats of Group IV elements as disclosed in U.S. Patent No. 4,175,972 the teaching of which is incorporated herein by reference and aromatic onium salts of Group Va elements disclosed in U.S. Patent No. 4,069,055

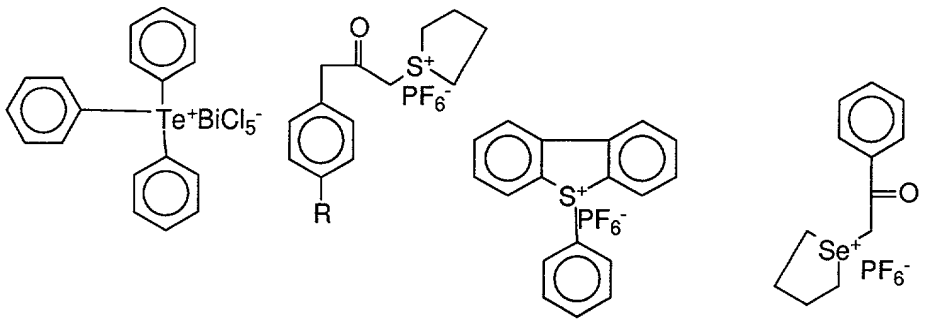
the teaching of which is incorporated herein by reference. Aromatic Group IVa onium salts include those represented by formula:

$$[(R)_{a(R^1)}b(R^2)cx]d^+ [MQe]^{-(e-f)}$$

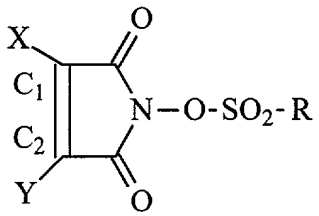
where R is a monovalent aromatic organic radical, R^1 is a monovalent organic aliphatic radical selected from alkyl, cycloalkyl and substituted alkyl, R^2 is a polyvalent organic radical forming a heterocyclic or fused ring structure. x is a Group IVa element or metalloid, Q is a halogen radical, a is a whole number from 0 to 3 inclusive, b is a whole number from 0 to 2 inclusive and c is a whole number equal to 0 or 1. Radical included by R are, for example, (C6-C) aromatic hydrocarbon radicals such as phenyl, tolyl, xylyl, naphthyl, anthryl and radicals substituted with up to 1 to 4 monovalent raducals such as C(1-8) alkyl, C(1-8) alkoxy, nitro, chloror, fluoro, and hydroxy; arylacyl radicals such as phenylacetyl; aromatic heterocyclic radical such as pyridyl and furyl; R^1 radical include C(1-8) alkyl, substituted alkyl such as -C2H4OCH3, -CH2-COCH3, etc. R^2 radicals include structures such as:


Complex anions included by $MQe^{-(e-f)}$ of above formula are, for example. $BF4^-$, $PF6^-$, $SbF6^-$, $FeCl4^-$, $SnCl6^-$, $SbCl6^-$, $BiCl5^-$, $AlF6^{-3}$, $GaCl4^-$, $InF4^-$ etc. Group VIa onium salts included by above formula are, for example:



Among non-metallic radiation degradable acid generators suitable for use in compositions of this invention are N-sulfonyloxyimides of the form:



where R is selected from the group consisting of toluene, benzene, CF3, CF2CF3, -(CF2)n-Z where n=1 to 4 and Z is H or alkyl or aryl and where X and Y either (1) form polycyclic ring which may or may not contain heteroatom, or (2) form a fused aromatic

ring or (3) may be independently H, alkyl or aryl group and C1 and C2 may form a single or double bond. The compositions of the present invention are preferably carried in a solvent or solvent system. The solvent or solvent system used in carrying these compositions preferably fulfills the need for providing uniform coating with complete coverage of the resist components on the substrate. The solvent preferably evaporates at temperature such that the photoactivity of the resist is not adversely impacted upon a drying step and will not take part in the operation of the photoresist (to be inert toward phenolic resin and/or crosslinker). Typical of these solvents are propyleneglycol monomethyl ether acetate (PGMEA), ethyl-3-ethoxypropionate (EEP), methoxypropanol, ethoxypropanol , butoxypropanol and ethyl lactate.

For formation of the negative tone image, the composition of the present invention is applied (for example, by spin-coating) on a substrate and the remaining solvent is evaporated by heating the substrate on a hot plate to temperatures of about 70-130 C for 1-3 minutes. The film is then imagewise exposed to Ebeam radiation at 100 kV. 200-370 nm upon which the radiation degradable component of the composition degrades and forms catalytic amount of acid. The crosslinking reaction between aliphatic hydroxyl calixarene dendrimer shown above and crosslinker is then accelerated by heating the substrate from 70-120 C for preferably one to three minutes. The images are thus rendered less soluble or insoluble in organic solvent. Typical of these solvents are propyleneglycol monomethyl ether acetate (PGMEA), ethyl-3-ethoxypropionate (EEP), methoxypropanol, ethoxypropanol, butoxypropanol

and ethyl lactate, and in the developing stage, the unexposed areas are removed by these solvents.

In another embodiment of this invention, the glycoluril derivatives which are used as crosslinkers are synthesized from corresponding dicarbonyl compounds as described.

Glycoluril derivative of this invention are highly soluble in the organic solvent of the choice, and compared to unsubstituted glycouril.

General procedure for preparation of alkyl-substituted Gycolurils.

Synthesis of alkyl-substituted glycolurils is exemplified by the synthesis of 3a-methyl-6a-propylglycoluril described below.

2,3-hexandione (1.0 mole) and urea (3.0 mole) were added to 2.0 liters of 2% hydrochloric acid and the solution is stirred at room temperature for 24 hours (alternatively, the solution could be refluxed for 2-3 hours). The precipitate is filtered and washed with water and then ethanol and dired. The off-white powder is then crystallized in acetic acid to give analytically pure tite compound in 45% yield.

Hydroxmethylation of Glycolurils.

The glycoluril derivative (0.10 mole) is suspended in 37% aqueous formaldehyde solution (0.5 mole) and the pH is adjusted to 10-11 with addition of 10% soiudm hydroxide. The resulting mixture is heated at 50 C for 24 hours after which all the solids are dissolved in the solution. The solution is cooled to room temperature and water is removed under reduced pressure. The residue (either solid or gummy material) is used in the next step without further purification.

Etherification of aminoplast compounds.

Tetrakis-hydroxymethyl glycolurils are converted to their corresponding tetramethoxymethyl derivative by suspending in excess of 2,2-dimethoxypropane, few drops of concentrated hydrochloric acid is then added and the mixture is stirred at room temperature for 24 hours. The solvent is removed under reduced pressure and the residue is either crystallized from appropriate solvent (as in the case of diaryl or alkyl aryl substituted glycolurils) or the oily residue is distilled under high vacuum and high temperature (e.g., in the case of methyl propyl or methyl butyl etc.) to give desired tetrakis-methoxymethyl derivative of glycourils.

The following examples are detailed description of methods of preparation and use of the process of the present invention. The detailed preparations fall within the scope of, and serve to exemplify, the more generally described methods set

forth above. The examples are presented for illustrative purposes only, and are not intended to restrict or limit the scope of the invention.

Example I: a) To .001mole (each mole has 8 hydroxyl groups) of the 2nd generation dendrimer formed from the reaction of 4-t-butyl calix[4]arene and dimethyl propionic acid, and b) .002 moles of 3a-methyl-6a-propyl-tetrakis-methoxymethylglycoluril (each mole has four reactive methoxy methyol groups) and 10 - 70% by weight of a and b combined of UVI 6974 which is the commercially available hexafluoroantimin oate salt of a mixture triphenyl sulfonium isomers from Union Carbide Corp., Danbury CT, are dissolved in the required amount of propyleneglycol monomethyl ether acetate (PGMEA) to make 3% by weight of components a, b and c. The resulting solution is filtered through 0.25 micron filter and spin coated on a substrate. After baking for one minute at 120 C, it is exposed with ca. 40-100 microcoulombs energy from a 100kV Leica Vectorbeam E-Beam Tool. After a post exposure bake at 120c for 1 minute, the photoresist is developed in a solution of 100% PGMEA for 1 minute. High resolution images (Fig. 1-4) with sub 100nm wide lines.

The pattern from the resist structure may then be transferred to the material (e.g., ceramic, metal, organic or semiconductor) of the underlying substrate. Typically, the transfer is achieved by reactive ion etching or some other etching technique. In the context of reactive ion etching, the etch resistance of the resist layer is especially important. Thus, the compositions of the invention and resulting resist structures can be used to create patterned material layer structures such as metal wiring lines, holes

for contacts or vias, insulation sections (e.g., damascene trenches or shallow trench isolation), trenches for capacitor structures, etc. as might be used in the design of integrated circuit devices.

The processes for making these (ceramic, metal, organic or semiconductor) features generally involve providing a material layer or section of the substrate to be patterned, applying a layer of resist over the material layer or section, patternwise exposing the resist to radiation, developing the pattern by contacting the exposed resist with a solvent, etching the layer(s) underlying the resist layer at spaces in the pattern whereby a patterned material layer or substrate section is formed, and removing any remaining resist from the substrate. In some instances, a hard mask may be used below the resist layer to facilitate transfer of the pattern to a further underlying material layer or section. Examples of such processes are disclosed in US Patents 4,855,017; 5,362,663; 5,429,710; 5,562,801; 5,618,751; 5,744,376; 5,801,094; and 5,821,469, the disclosures of which patents are incorporated herein by reference. Other examples of pattern transfer processes are described in Chapters 12 and 13 of "Semiconductor Lithography, Principles, Practices, and Materials" by Wayne Moreau, Plenum Press, (1988), the disclosure of which is incorporated herein by reference. It should be understood that the invention is not limited to any specific lithographic technique or device structure.

While this invention has been described in terms of certain embodiment thereof, it is not intended that it be limited to the above description, but rather only to the extent

set forth in the following claims. The embodiments of the invention in which an exclusive property or privilege is claimed are defined in the appended claims. The teaching of all references cited herein, are incorporated herein by reference.

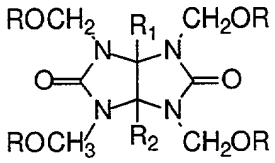
Claims:

What are claimed are:

1. A method of forming a pattern of photoresist which comprises: providing on a substrate an uncured film comprising: a film forming, soluble aliphatic hydroxy functional dendrimer of generation 2 (at least 8 hydroxyl groupos) r; a glycoluril derivative; a photoacid generator; an organic solvent; imagewise exposing said film to E-Beam energy in a pattern to thereby cause generation of acid catalyst in said pattern; baking of said exposed film at 90 -130 C for 1-2 minutes; and developing said photoresist in an organic solvent.e solution.

2. A method according to claim 1 wherein the exposure is E-beam energy of less than 1 milli coulombwavelength.

3. The method according to claim 1 wherein said glycoluril derivative has general formula:



Glycouril derivatives

in which R_1 and R2 can be selected individually from the group consisting of alkyls having 1-6 carbons, alkenyls, alkoxy

4. A method according to claim 1 wherein said photoacid generator is selected from onium salts of group IV elements.

5. A method according to claim 1 wherein said photoacid generator is selected from onium slats of Group V!a elements.

6. A method according to claim 1 wherein said photoacid generator is selected from sulfonate of N-hydroxyimides.

7. A method according to claim 1 wherein the photoacid generator is the hexafluoroantimiate of a triaryl sulfonium.

8. A method according to claim 1 wherein said aliphatic hydroxyl containing dendrimer, said glycoluril derivative said photoacid generator and said solvent form an admixture comprising:

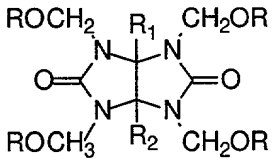
from about 90% to about 60% of said dendrimer, from about 5% to about 20% of said glycoluril derivative, and from about 2% to about 20% of said photoacid generator.

9. A method of forming a pattern of photoresist which comprises: a film of an admixture comprising: a dendrimer; a glycoluril derivative; a photoacid generator; an organic solvent; an organic base; imagewise exposing said film to E-beam energy of less than 1 millicoulomb in a pattern to thereby cause generation of acid catalyst in said pattern; baking of said exposed film; and developing said photoresist.

10. A composition of matter comprising: an admixture of a aliphatic hydroxyl containing dendrimer with at least 8 hydroxyl groups per molecule; a glycoluril derivative; a photoacid generator; an organic solvent; an organic base.

11. A composition according to claim 13 wherein said phenolic resin is an aliphatic hydroxyl containing dendrimer with at least 8 hydroxyl groups per molecule.

12. A composition according to claim 13 wherein said glycoluril derivative has general formula:



in which R_1 and R_2 can be selected individually from the group consisting of alkys having 1-6 carbons, alkenyls, alkoxys.

13. A composition according to claim 13 wherein said photoacid generator is selected from onium salts of group IV elements.

14. A composition according to claim 13 wherein said photoacid generator is selected from onlium salts of Group Vla elements.

15. A composition according to claim 13 wherein said phenolic resin or polymer, said glycoluril derivative, said photoacid generator and said solvent form an admixture comprising from about 40% to about 80% of said dendrimer resin or polymer, from about 5% to about 25% of said glycoluril derivative and from about 2.0% to about 20% of said photoacid generator.

16. A method of forming a patterned material structure on a substrate, said material being selected from the group consisting of semiconductors, ceramics, organics and metals, said method comprising:

(A) providing a substrate with a layer of said material,

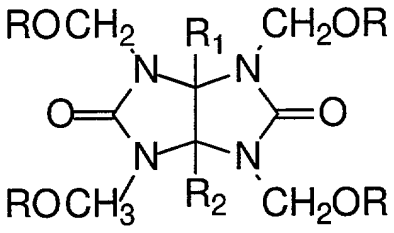
(B) applying a resist composition to said substrate to form a resist layer over said material layer, said resist composition comprising: an admixture of a aliphatic hydroxyl containing dendrimer with at least 8 hydroxyl groups per molecule; a glycoluril derivative; a photoacid generator; an organic solvent and an organic base;

(C) patternwise exposing said substrate to radiation whereby acid is generated by said radiation-sensitive acid generator in exposed regions of said resist layer by said radiation,

(D) contacting said substrate with an aqueous alkaline developer solution, whereby said exposed regions of said resist layer are selectively dissolved by said developer solution to reveal a patterned resist structure, and

(E) transferring resist structure pattern to said material layer, by etching into said material layer through spaces in said resist structure pattern.

17. The method according to claim 16 wherein said glycoluril derivative has general formula:



in which R_1 and R2 can be selected individually from the group consisting of alkyls having 1-6 carbons, alkenyls, alkoxy.

18. A method according to claim 16 wherein said photoacid generator is selected from onium salts of group IV elements.

19. A method according to claim 16 wherein said photoacid generator is selected from onium slats of Group V!a elements.

20. A method according to claim 16 wherein said photoacid generator is selected from sulfonate of N-hydroxyimides.

21. A method according to claim 16 wherein the photoacid generator is the hexafluoroantimiate of a triaryl sulfonium.

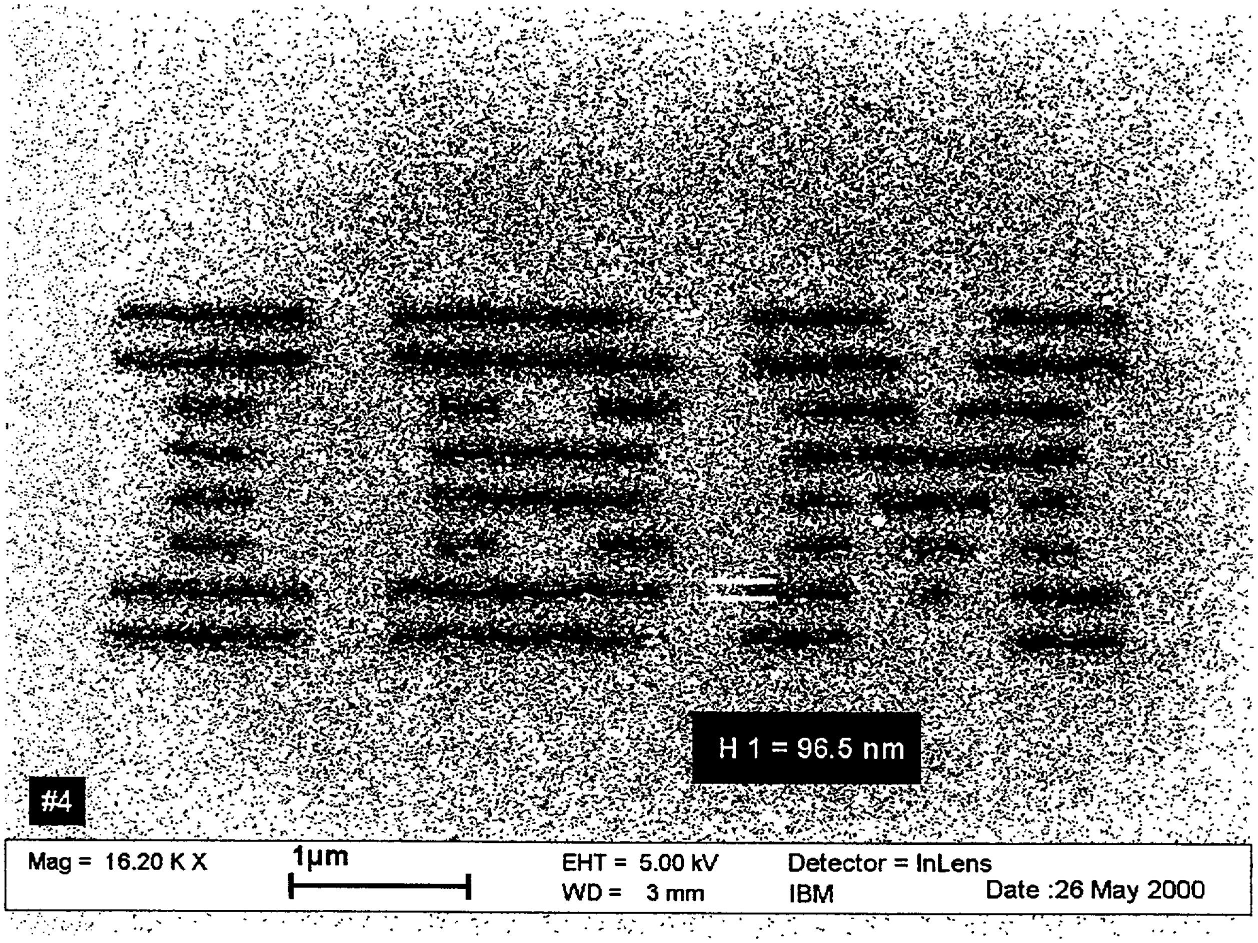
22. A method according to claim 16 wherein said aliphatic hydroxyl containing dendrimer, said glycoluril derivative said photoacid generator and said solvent form an admixture comprising:

from about 90% to about 60% of said dendrimer, from about 5% to about 20% of said glycoluril derivative, and from about 2% to about 20% of said photoacid generator.

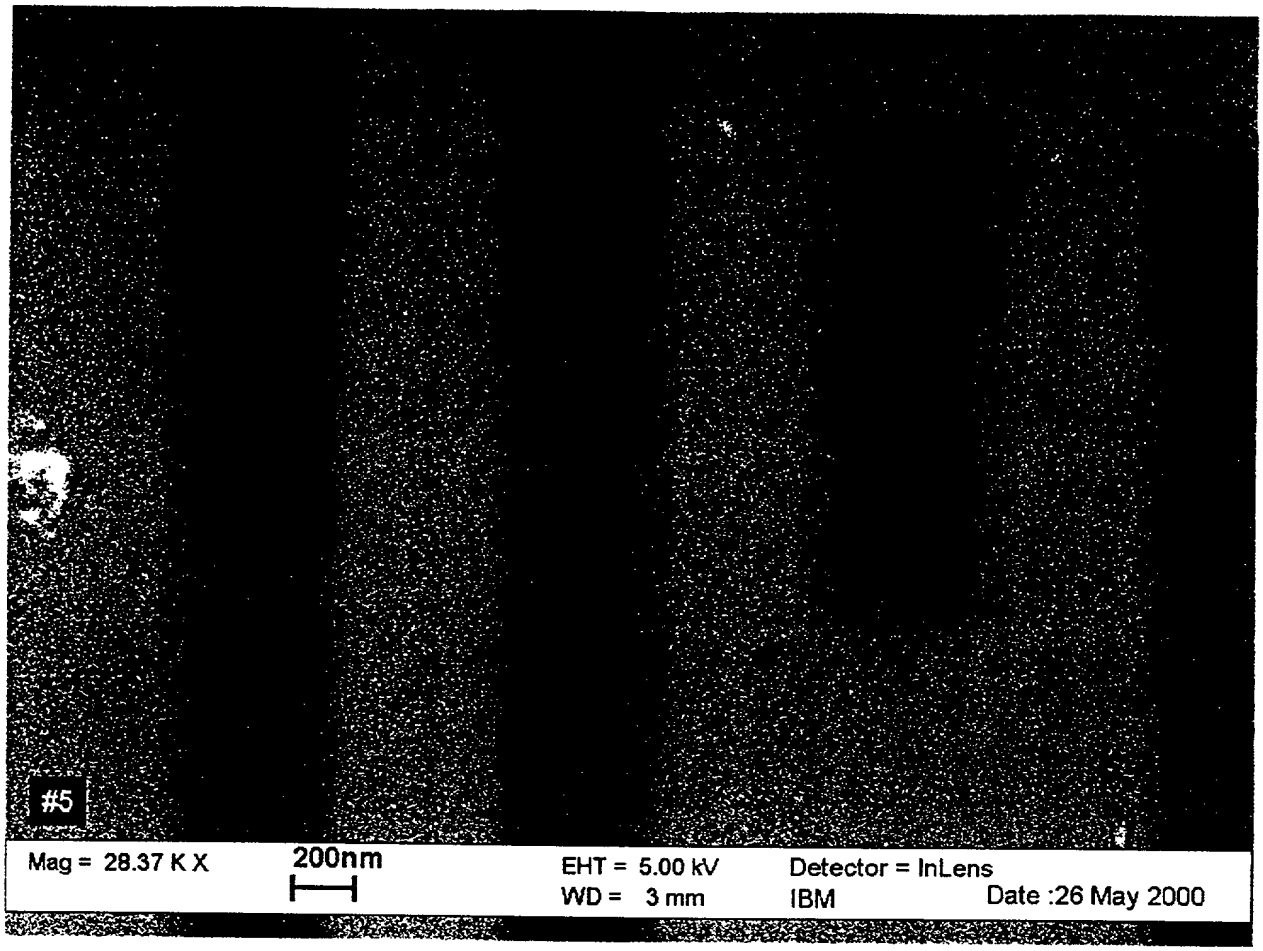
HIGH SENSITIVITY CROSSLINKABLE PHOTORESIST COMPOSITION, BASED ON SOLUBLE, FILM FORMING DENDRIMERIC CALIX[4]ARENE COMPOSITIONS METHOD AND FOR USE THEREOF

ABSTRACT

A high sensitivity, organic solvent developable, high resolution photoresist composition for use in E-beam lithography is disclosed. The composition of the present invention comprises a high sensitivity, soluble, film forming photoresist composition of dendrimeric calix[4]arene derivatives and processes for forming lithographic patterns with a crosslinker selected from glycoluril derivatives capable of reacting with these dendrimer under acid catalysis, a photoacid generator and an organic solvent. The composition of the present invention is particularly useful for production of negative tone images of high resolution (less than 100nanometers).



Photograph one



photograph 2

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name;

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

HIGH SENSITIVITY CROSSLINKABLE PHOTORESIST COMPOSITION, BASED ON SOLUBLE, FILM FORMING DENDRIMERIC CALIX[4]ARENE COMPOSITIONS METHOD AND FOR USE THEREOF

the specification of which (check one)

__X__ is attached hereto.

_____ was filed on _____ as United States Application Number _____

or PCT International Application Number _____

and was amended on _____ (if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the patentability of this application in accordance with Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, '119(a)-(d) or '365(b) of any foreign application(s) for patent or inventor's certificate, or '365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application, having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s)			Priority Claimed
_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	___ Yes ___ No
_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	___ Yes ___ No
_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	___ Yes ___ No

I hereby claim the benefit under 35 U.S.C. '119(e) of any United States provisional application(s) listed below.

60/208,269 (Application Number)	May 31, 2000 (Filing Date)
_____ (Application Number)	_____ (Filing Date)

I hereby claim the benefit under 35 U.S.C. '120 of any United States Application(s), or '365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States, or PCT International application in the manner provided by the first paragraph of 35 U.S.C. '112, I acknowledge the duty to disclose information material to the patentability of this application as defined in 37 CFR '1.56 which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

_____ (Application Serial No.)	_____ (Filing Date)	_____ (Status) (patented, pending, abandoned)
_____ (Application Serial No.)	_____ (Filing Date)	_____ (Status) (patented, pending, abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY: As a named inventor I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith (list name and registration number).

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